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FRDA REPORT 068

SUBSTITUTION: THE REAL THREAT TO BC'S WOOD PRODUCTS SECTOR

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FOREWORD

In addition to the monthly surveys of the BC sawmill sector, quarterly reviews of key selected topics are undertaken. This review examines the nature and extent of substitution by alternative materials on products and markets.

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EXECUTIVE SUMMARY

Substitution by alternative materials poses more of a threat to the wood products industry than sales lost to competing regions and losses in production and employment. Substitution represents the potential for the eventual permanent loss of large, higher-valued parts of sectors previously dominated by wood and can open doors permitting further encroachment.

Dramatic examples of substitution by metal, plastic or concrete are examined in products traditionally dominated by wood. Examples where successful capture of market share has been lost--such as the UK timber frame market--is explored and lessons to be learned are identified.

Examples of wood products under seige by other materials are listed and, where possible, quantified.

It is significant that much of the data obtained on trends in market share are more readily obtained from representatives of that substitute--such as the aluminum, steel or concrete associations, than from those representing wood. In fact there is only limited information available on how wood is used in Canada.

Strategies to limit the encroachment of substitute materials are explored under the categories of technologies, processes, marketing and industry/government organization.

The impact of campaigns such as the UK's "Think Wood" or Forintek's "Wood Works" is hard to quantify, yet intuitively effective. However, it also requires backing up at a more individual level. An overlooked theme is evident in this report: everyone involved in the wood products sector has much at stake in both advocating and in furthering appropriate use of wood.

1
INTRODUCTION

We live in a rich world surrounded with surpluses--of inventories of available semi- and fully-finished products, of too many shopping centres and overflowing shops and supermarkets all competing for the consumers attention and dollar. This competition is especially fierce at the commodity sector shared by raw materials such as wood, plastics, metal and concrete where there are giant producers with existing large scale highly efficient facilities.

In specialty products sectors--consumer electronic goods, for example--there are adequate margins of profit and such rapid advances in technologies that survival has focussed on continuous rapid introduction of new items--many of which did not exist years of even months ago. This is not the world of solid wood products. Wood fulfills basic needs such as domestic shelter, home furnishing, storage and packaging. Neither is wood's competition with substitutes image-conscious or as subtle as the "Coca-Cola versus Pepsi" war. Consumers of wood or its competing products are buying technical performance and service and are very cost conscious. With the exceptions of appearance or feel of certain wood products such as furniture or decorative trim, there is little brand loyalty.

Having said that the consumer is oversupplied by competing commodity products, it is largely his perception which he employs to decide which material to purchase. His perception of wood or plastic or metal may be good or bad--or valid or invalid. It may come from first hand experience, hearsay or from advertising.

Markets for wood products are continually challenged by competing non-wood materials such as plastics, steel and concrete. Examples of products where substitution of wood is having a significant impact include:

Figure 1
Examples of Substitution of Items
Traditionally Made of Wood

- Housing parts - windows, doors, siding soffits, trim panelling, gutters downspouts, fencing and structural elements such as joists and studs
- Furniture - tables, chair
- Ladders - from aluminum steel and fibreglass
- Tool handles - hammers, picks, brushes
- Mouldings - trim, picture frames
- Utility poles and foundation piles
- Toys (especially mass produced)
- Pipe (stave), flume
- Kitchen utensils (especially dishwasher or microwave proof)
- Sporting goods (baseball bats, hockey sticks, tennis racquets, etc.)
- Railway ties
- Mine props
- Packaging - corrugated paper, plastic, boxes, barrels
- Spindles/bobbins
- Pallets - plastic or steel
- Shop display/racking/shelving
- Boat parts, hulls, masts, fittings
- Utility wire reels
- Matches

It is important to understand that promoters of substitute materials such as Canada's very sizable aluminum, copper, concrete and oil-based plastics sectors are well organized, politically well established and have employed well developed strategies to enhance their products. The wood industry must collectively fight back (Section 5) with proactive and technically sound strategies. Further these strategies must pervade every action by everyone in the wood industry--whether a production worker, a research scientist or a consultant.

The significance of the wood industry to Canada is enormous and is well documented. While Canada continues to extract record volumes of all wood products from an increasingly defined and finite resource, major product sectors are receiving significant competition from other materials.

Rapid Rate of Change Needs Rapid Responses and Current Data

It is significant that many of these products or sectors where substitution began only a few years ago have been significantly and often irreversibly overtaken by competing materials. This rapid rate of change requires equally prompt action.

Only the wood products sector can be blamed if it relies on largely obsolete market share information obtained from other sectors and is slow to react with strategies to limit substitution.

The data needed to monitor change must be current. Statistics Canada data are generally not published in time for appropriate action and the production categories and product groupings tend to be too general to identify what is happening in a given sector such as for example the production of hemlock window stock.

Mainly Higher-Valued Products Attract Substitution

Canada's softwood lumber products have usually filled the traditional niches as structural building materials, and a multitude of low-valued functional roles such as poles, posts, ties, fencing and packaging items. Only in recent years has the emphasis swung from volume to value-added production and little attention was given to the inroads made by substitution of other materials. Other materials--especially plastics--were perceived (incorrectly) as being "cheap and nasty" and hence only worthy of substitution of low-value products. We forgot that plastics are in their infancy and that the appearance, properties and function they now offer permits them a deserved place in the competition for high-value products.

Some Substitution is Needed and Welcome

A certain degree of substitution must be considered both logical and welcomed. For example, moulded gutters and down spouts for housing was a poor application for wood, made necessary by a lack of the more appropriate materials now available--such as plastic or aluminum.

There is little merit in mourning the passing of many traditionally wood products, when the raw material required is either no longer readily available, or economic. Examples of this would include wooden utility poles and pilings where the needed sound straight cedar or fir stems are either unobtainable, or where their limited supply has made their use uneconomic. Concrete poles will permit a conservation of the limited wooden pole stems for more appropriate end uses which can bear those elevated costs.

Real Threat for Wood's Traditional Markets

It is also worth emphasizing that it is not the substitution of one wood product by another--such as sheathing plywood by OSB or cedar by treated pine that is at issue, it is the substitution of a wood product by say aluminum, steel or plastic which causes a partial revenue and employment loss which, if not confronted, leads to permanent losses. For example, the substitution of say softwood plywood sheathing by OSB or cedar by treated pine still maintains revenues and employment in BC and is a logical and economic response to changes in the resource, available process and product technologies and market place demands. However, the change towards other materials--such as uPVC windows, steel doors or vinyl mouldings directly impacts on revenues and employment in the wood sector.

These substitutions cause a permanent reduction in the solid wood products sector.

This report gives examples where substitution by competing materials is:

- underway;
- has virtually replaced wood;
- has been effectively recaptured by wood;
- potentially recapturable if available, or future, technologies or production practices can be implemented.

Strategies to limit substitution are outlined, along with the identification of who should adopt and implement them.

There is clearly a need for industry to adopt a proactive stance.

2

EXAMPLES OF SUBSTITUTION OF WOOD; ESTIMATES OF MAGNITUDE, TRENDS AND IMPACT

Much of the market share information available has been obtained from promotional literature from associations representing competing materials--such as uPVC for windows or aluminum for windows, siding and doors. Clearly this information is sufficiently important to the wood products sector to not rely on what the competition is saying. Statistics can be edited--by selecting certain time periods, for example, which embellish a given point of view. These data should at least be obtained and published by relevant wood products associations.

Market share distributions of market share also fail to indicate the absolute magnitude of the volume in terms of say number of windows, or dollar value of the window sector--nor do the say whether the total market is increasing in size--or if the unit value or board footage consumed per unit is also increasing and distorting the distribution.

Typical market share trends obtained from an aluminum association publication reveal some disturbing trends.

US Window Market

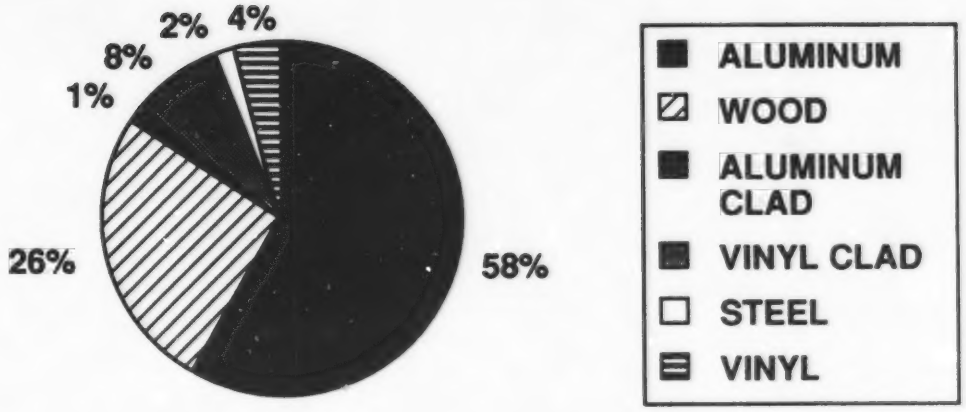
The US window market is now largely dominated by aluminum as is shown in Figure 2.

By 1982 the share of wood had dropped to 26% and more recent figures for 1987 indicate that the vinyl windows had again almost doubled their market share. Of particular concern is the growth in market share in the very important repair and modelling sector.

1985	11%
1986	17%
1987	20+%

Source: Alumi News

Figure 2
United States Window Raw Material
% of Market 1982



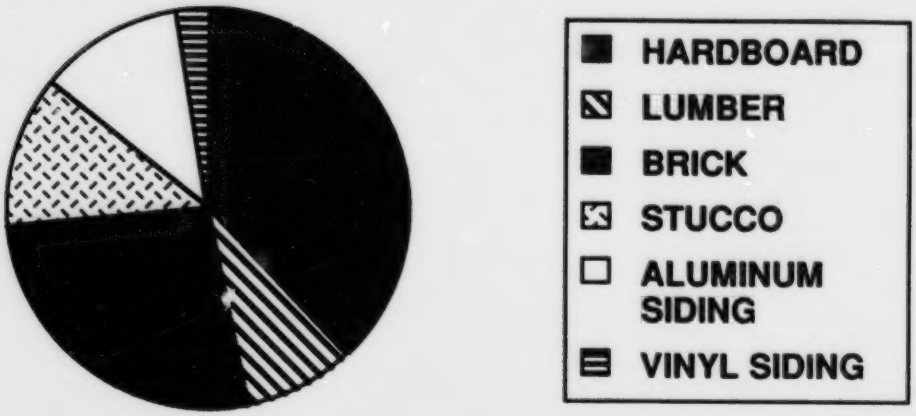
	% change since 1974
Aluminum	+ 16
Wood	- 12
Aluminum clad	n.a.
Vinyl clad	+ 167
Steel	n.a.
Vinyl	+ 100

This trend would indicate that marketing, advertising and sales efforts are particularly fruitful when directed at DIY users and at the retail distribution level.

US Siding Market

Lumber has only a small share but hardboard had claimed a substantial portion of the market. However, it is believed that since 1982 aluminum and vinyl sidings have become very much more significant. Recent forecasts indicate a depressing outlook for wood products.

Figure 3
United States Siding Market Raw Material
% of Market 1982



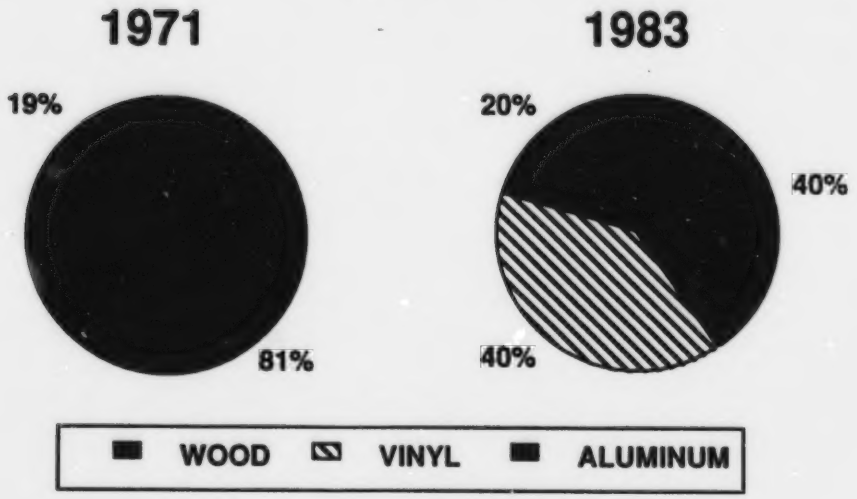
	1988	1995
Aluminum	13	12
Vinyl	23	31
Brick	17	13
Hardboard	17	17
Wood	2	1

Source: "PREDICASTS"

German Window Market

The trend away from wood is not limited to the US. It is evident from Figure 4 that there has been a substantial erosion in the share of wood in windows in West Germany. From over 80% in 1971, wood windows only held a 40% share by 1983.

Figure 4
West German Window Market
Raw Material

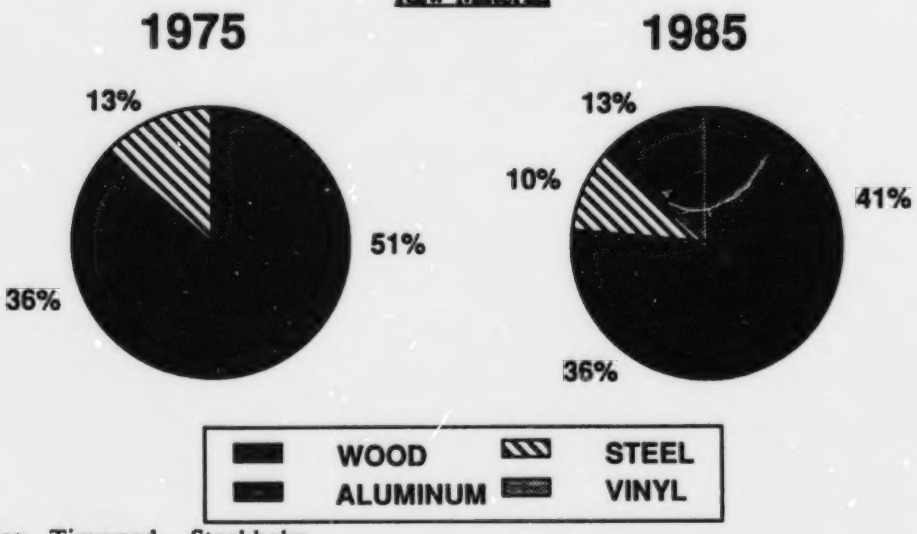


Source: Timwood - Stockholm

UK Doors and Windows

The UK joinery market has also suffered, as can be seen in Figure 5. Again it is the plastics industry that is aggressively taking market share -- to the detriment of wood.

Figure 5
UK Door and Window Market
Raw Material



Source: Timwood - Stockholm

A recent report finding by Palmer Market Research in the UK was that softwood doors and joinery sales are consistently losing out to hardwood, which in turn is losing out to uPVC and aluminum. Wood now has no more than 17% of the 3 million square metres of the annual UK door market. In the home improvement sector, softwood sales hardly grew at all, though both hardwood and uPVC sales grew 25% per year and uPVCs sales were up 25% on a sales base six times larger than hardwoods.

The report cites failure of wood to adopt direct (door to door and telephone) sales techniques adopted by the more aggressive aluminum and uPVC promoters. Further, uPVC and aluminum door makers are enhancing their products by introducing in-fill panels to mimic hardwood doors.

Lessons To Be Learned From Market Research

It is significant that the one source of data widely cited is "Alumi News", largely due to a lack of such information being readily available from wood product industry sources. Also these data, while highlighting dramatic shifts away from wood are largely obsolete (i.e. 1982 vintage). The plastics industry in 1982 had barely begun to produce materials appropriate for usage in housing. Similarly plastics in 1982 occupied such a small market share that a doubling of that share was comparatively easy to accomplish, compared to major market share holders.

These market research studies indicate dramatic shifts away from wood. However, both these sources and displays suffer from:

- being obsolete--continuous sampling is needed rather than an occasional study;
- unclear in the units used--i.e. number of windows--or dollars, or feet board measure and whether raw material values or finished product values are employed;
- lack of perspective--how significant are each of the product/country volumes in terms of absolute magnitude. For example, in Figure 5, UK door and window raw material represented a £218 million market in 1975 but a £813 million market in 1985;
- failure to identify causes or preferences.

The decline of the wood window share in West Germany to vinyl was not due to lower prices--vinyl is more expensive--but presumably was perceived to offer a better overall value in terms of cost of installation and subsequent maintenance, looks, variety, etc. Similarly, the very dramatic growth in the market share in exterior doors in the US earned by embossed steel may be associated with a perception of fire and burglar resistance.

Market share studies of the apparent substitution should indicate that hybrids--that is composites of wood and other materials--should be accounted for as such, since they represent synergistic combinations which can lead to more widespread application in other areas and do not represent a total loss to either materials. For example, 90% of Anderson exterior windows (the major US producer) are wood cored, vinyl clad.

Market share data on offshore markets are needed--however, more significantly due to proximity and scale of the markets, Canada's wood products industry does not know what substitution is taking place in the US market.

Utility Poles

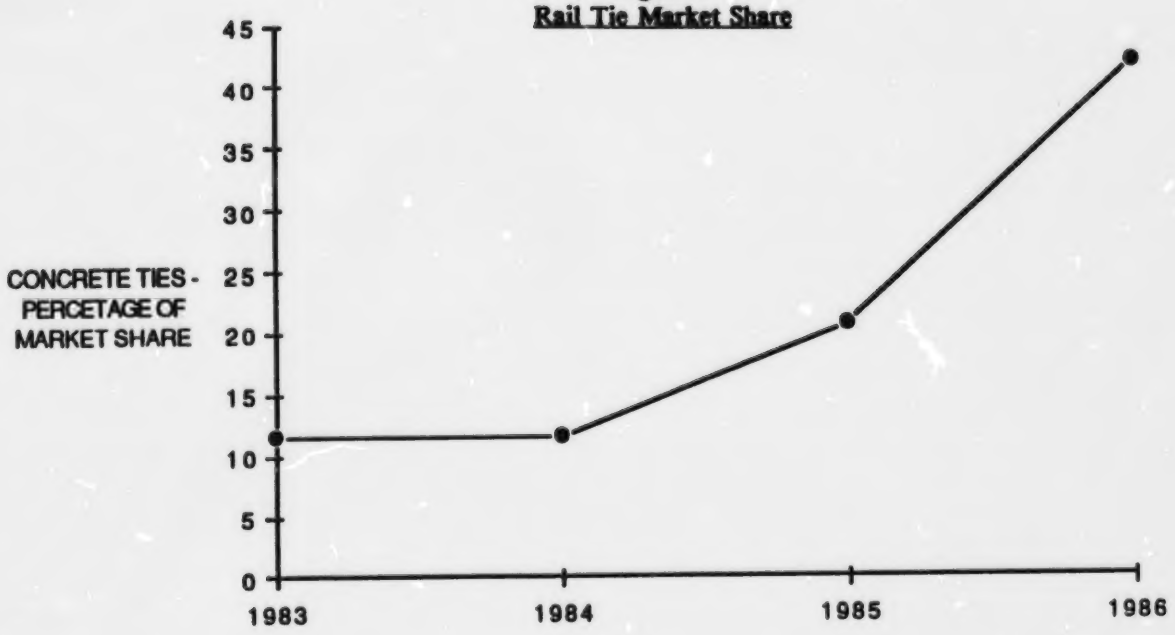
Substantial inroads into the traditional market for utility poles in wood have been made by spun tubular concrete and sheet steel fabrications. As if to highlight their successful encroachment many new utility poles in new or replacement applications within BC are now in concrete, each bearing a shiny stainless steel makers advertisement (Spun Beton Products Ltd. of Kamloops). When did wooden utility poles ever carry a message?

Railway Ties

Traditionally wood exclusively held the railway tie market and numerous small sawmill ("bush mills") had provided the 3 to 5 million ties per year used for replacement and new trackage in Canada. Treating ties with creosote/diesel oil had also provided major employment.

In the early 1980s concrete ties, with cast in place rail clips, were introduced and their growth in market share is shown in Figure 6.

Figure 6
Rail Tie Market Share



Overhead Garage Doors

Overhead garage doors represent a severe service application due to a combination of damage, sunlight and weathering, the need to retain their shape to function and their need to retain a good appearance without considerable maintenance.

Originally dominated by wood/plywood insert panels, they have been largely substituted first by steel, aluminum is presently favoured and possibly vinyl will be next.

Steel Studs

Studs fabricated in zinc galvanized sheet steel were mandated by fire codes in light industrial and office building applications. However, they have made slight inroads into the residential housing and apartment markets.

In Australia the Australian Steel Corporation has been actively promoting steel studs for house framing and have presently captured a 3.5% market share from wood.

In Australia steel framing currently has a 3% share of the additions and renovations market and expects to have half the market by the year 2000, when steel should account for 15% of Australia's framing market.

Wood is a preferable material for studs, hence a campaign to offset steel is justified.

Concrete Housing

Misawa Homes, Japan builds about 35,000 homes per year from its 23 housing factories. About 10% of Misawa homes are made in a lightweight ceramic material called Precast Autoclaved Lightweight Ceramic - PALC. Starting in 1981, Misawa identified that increasingly costly and scarce lumber supplies would limit their business at the 22 stressed skin wood panel plants - so they spent over $60 million on research and pioneered a PALC plant. PALC uses silica sand, limestone and portland cement along with foaming agents and results in a panel which is 75% air, 5% moisture and 20% solids. All the ingredients are available worldwide--in fact silicon, oxygen and alumina represent 82% of the weight of the planet.

Misawa produces the wall panels for a home in 40 minutes, can erect a home in a mere two hours and give a guarantee of 20 years. Due to the trapped air bubbles PALC houses offer wall insulation levels 10 times better than concrete and the wall panels float.

In St. Louis, Missouri Hexacomb Panel Systems produces 250 panelized homes per year employing concrete hexagonal honeycomb wall modules.

Pallets

Injection moulded plastic and sheet steel rivetted and welded pallets have made significant inroads into the returnable pallet sector. Mass users can justify higher initial costs ranging from $50 to $150 per pallet based in many more trips, reduced maintenance and disposal costs and added benefits such as enhanced dimensional accuracy and grooved decks to support plastic tote boxes. General Motors estimate that annual sales of pallets to the Canadian automotive industry accounts for a significant 625 million board feet of low grade hard and soft woods.

The Canadian Forestry Service has assisted the wood pallet industry to offset the competition posed by plastic.

A consortium of the Canadian Wood Pallet and Container Association, the Alberta Pallet Company and Forintek developed a moulded wood based pallet deck overlay panel (called Modeck) which is now undergoing field trials in the automotive industry.

The Impact of Substitution on the Wood Products Sector

Impact of Substitution on Employment

Examination of trends in employment for three material sectors in Canada, lumber, plastics and aluminum fails to separate out other factors such as cyclical markets or labour savings efficiencies does not indicate any impact that substitution may be having on employment levels. It is not possible, therefore, to demonstrate with any statistical evidence how much employment is lost by the wood industry due to the substitution by other products. However, since these other products tend to have less labour intensive processes, it is likely that there is a net loss of employment and certainly a loss to the forest industry.

3
CAUSES OF SUBSTITUTION, REAL AND PERCEIVED

It is important to recognize the influence of public perception in its purchasing decisions and the role that advertising plays in creating, then guiding those perceptions. A large difference exists between the use of wood in housing in England and either North america or Scandinavia. The cement, brick and stone associations in England have benefitted by increasing their already large majority share by the lack of response and action by the UK timber industry to adverse publicity focussed on wood.

Causes of Substitution

Adverse Publicity encouraged by substitute product associations

UK Timber Frame Housing Starts

Timber framed housing in the UK has never been as common as brick built houses yet up to 1983 had been earning an increasing share. By June 1983 timber framed housing represented 22% of the new home total. However, a two part TV series "World in Action" called "Your Home in Their Hands" aired in June 1983 and cited three major areas of concern with timber frame houses:

- wood rot caused by interstitial condensation, in turn set up by torn plastic vapour barriers;
- badly assembled components, such as sheathings only partially nailed to studs;
- increased fire damage risk caused by shoddily assembled fire stops--or lack of fire stops.

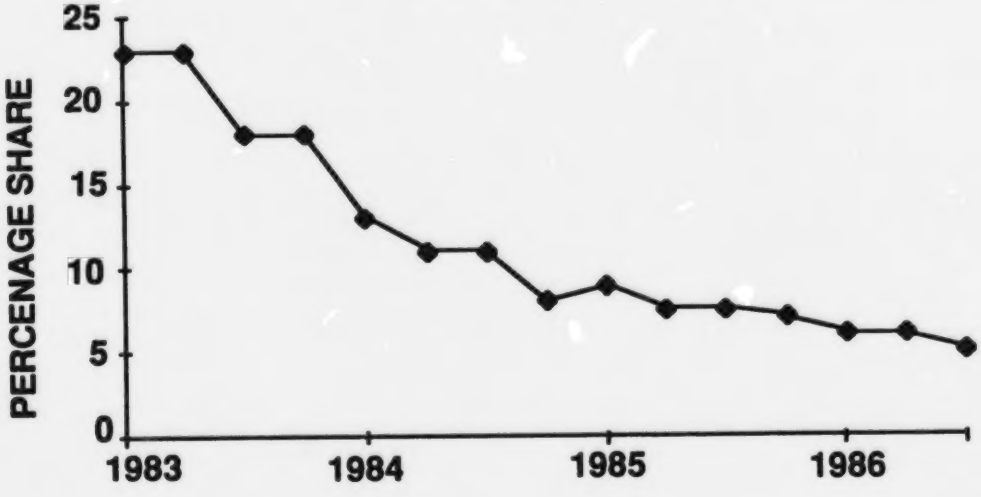
Despite limited efforts by the British Woodworking Federation and others, the market share plummeted and has not recovered as shown in Figure 7. The TV program was subsequently branded "highly misleading and unfair" by the British Broadcasting Complaints Commission, however, the subsequent loss of market share by the timber frame industry was a telling reminder of the instant (and enduring) power of TV.

The "Timber and Brick Homes Consortium" was set up in 1984 to heal the gaping wounds inflicted in the timber frame industry but with only meager success.

Subsequent and irrelevant reports of fires at a football stadium (Bradford) and an underground station (Kings Cross, London in November 1987) have apparently reinforced public opinion connecting wood and fire hazard.

Though largely directed at on-site quality deficiencies and shoddy workmanship in UK timber framed housing, the "World in Action" program demonstrated the public's latent mistrust in timber construction. The efforts of the various wood industry associations to achieve the pre-1983 market share and their subsequent efforts could once more be jeopardized by misleading and highly selective one-hour TV program.

Figure 7
Timber Framed Housing In England



Inappropriate Application for Wood

In Italy external windows are commonly fitted with roller blind sunshades. Attempts to provide varnish finished wooden slat blinds failed due to blistering of the varnish caused by ultraviolet radiation from sunlight. The wood darkens in the resulting unprotected areas. Clearly this product is highly visible and gives wood a bad reputation, hence alternative materials should be employed unless a better treatment of wood can be found.

Changes in Lifestyle

Changes in society and lifestyles place differing requirements, for example, on the ability to pay premium prices for say housing components which offer additional benefits such as low maintenance, security, thermal and noise insulation and a prestigious image.

As an example of the influence of advertising, a campaign by the concrete association in Phoenix was entitled "The solid way to build". The inference was that people now want more permanent high class homes and should now move up to concrete.

Durability of Wood

Durability clearly implies longevity when exposed to a defined operating environment and measured in terms of ability to continue to perform desired functions. For example, inappropriate applications for wood--poor protection or bad design have lead to wholly unacceptable service and premature need for its replacement. Experience with generations of poorly designed and protected exterior window frames, with the attendant problems of peeling paint, rot, swelling and jamming has deservedly caused a major shift to uPVC or aluminum frames. Yet wood can be, or can be modified to be, exceptionally durable.

Chemical treating and kiln drying technologies to preserve wood are well understood and actively being developed and employed. Two examples, where the environment has permitted extreme durability to be demonstrated are:

1) In 1988 at a site on Axel Heiberg Island in the Canadian arctic, the remains of a forest was found. The wood, preserved by the ice is in perfect condition and was sawn, burned and the various species easily identified by their cell structure. How long had the wood laid there? -- 45 million years.

2) Sweden's warship "Vasa" spent 333 years in 110 feet of brackish water in Stockholm's harbour and England's "Mary Rose", Henry VIII's flagship, spent 437 years at the bottom of the sea before being raised. These vessels are in exceptionally good condition and are perfect advertisements, on public display, of the potential durability of wood.

Upgrading of Publicly Subsidized Houses

Many of the publicly subsidized houses in the UK built in the peak period in the late 1960s are now undergoing major refurbishment including replacement of wooden doors, sills, windows etc. Many of the county councils responsible for refurbishment have set up their own plants to produce replacements and the overwhelming choice in materials is uPVC. This choice reflects dissatisfaction with the service life of wood.

Flammability of Wood

The various local and national fire regulations have already imposed severe limitations on the use of wood in commercial and high-rise building applications and specific regional concerns such as the shake and shingle use in California is indicative of the encroachment in the residential sector.

Chemical treatments and building practices to retard the flammability of wood is well researched and widely employed.

Strength Variability

Prior to the mechanical strength rating (MSR) method of grading lumber, the strength properties of wood were perceived to be highly variable with a resulting underselling of certain species and the general over-design of wooden structures.

Meccano Approach

Other products, notably steel provide pre-cut components in kit form which permits quick yet flexible building with a minimum of on-site cutting and fitting.

Maintenance Needs

Other products highlight their lack of need maintenance in service, which appeals to today's "faster pace" lifestyle.

4

STRATEGIES TO LIMIT THE SUBSTITUTION OF WOOD EMPHASIS POSITIVE ATTRIBUTES

The basis of strategic analysis is to identify strengths and opportunities and maximize them--and to identify weaknesses and threats and to minimize them. In the increasingly environmentally sensitive world we live in, wood offers many noteworthy benefits including:

- low in energy consumption to produce;
- obtained from a completely renewable source;
- reforestation: consumes carbon dioxide, generates oxygen, stabilized soil erosion, adds nutrient to soil, provides resource for tourism, recreation, wildlife;
- non-toxic product in service;
- the use of softwood versus hardwood from environmentally sensitive tropical forests;
- non allergenic;
- production wastes are bio-degradable;
- after its service life the waste materials are safely disposable.

In addition wood offers the end user many additional benefits:

- a natural product with centuries of service experience;
- speed of erection giving improved cash flow benefits;
- wide variety of aesthetically pleasing finishes possible for exposed wood surfaces;
- light in weight for materials handling on site;
- excellent thermal insulation properties;
- wide range of sizes and finishes readily available and competitively priced;
- ease of cutting, joining, gluing, nailing, etc. using existing tooling and single trade skills;
- flexibility in design and subsequent renovation to suit changes in lifestyles such as the addition of "granny suites";
- close integration with other building components - sheathing, paster board, tiling;
- ease of adding building systems such as plumbing and electrical;

- natural flexibility permits limited movement without cracking;
- cavities formed in exterior wall construction permits easy installation of insulation;
- durability and flammability can be modified to suit the particular application;

A new material, "taking on" wood, will promote the ways in which that material is superior to the real (or perceived) shortcomings in wood. A listing of these reasons for the substitution of wood is given in Figure 8. Strategies which both minimize the real and perceived shortfalls of wood and which address head-on the real and perceived advantages of competing materials can be drawn up.

Figure 8
Real and Perceived Reasons for Substitution of Wood

- Premature service failure of wood when installed in inappropriate locations
- Poor manufacturing or installation techniques directly contribute to failure of wood
- Vinyl is extremely price competitive
- Erratic supply and pricing
- Rots
- Weak
- Checks, splits
- Shrinks

Proactive strategies are the most effective in that they require examination and identification and definition of all influencing factors, then the introduction of careful modifications to selected influencing factors. They often require team effort to develop, further enhancing their likelihood of success.

Needed Changes in Strategies and Marketing Emphasis

Until recently the new housing start rates tended to be the major factor by which the "health" of the primary wood products business was monitored. Studies of the actual end use of primary lumber indicated, however, that new housing consumed only one-third of lumber produced and, surprisingly, repair and renovation (R&R) was consuming a similar quantity in most marketplaces. Further, the rate of growth in consumption was in R&R, not in new home consumption. Substitution strategies and marketing emphasis which recognizes this important trend will be the most effective. The advertising, product use information and the places and types of displays, including packaging and wrapping and quantities should address the R&R end user. Typically, R&R is undertaken by small contractors--say 3-5 employee groups or by the over the shoulder DIY amateur. These people will pay a premium for well presented products, which can be easily installed with amateurs' tools and which complement his efforts and often his personal dwelling. Tract builders of new houses on the other hand tend to be more price sensitive and they are more familiar with alternative products from other sources of supply.

"Wood is Upscale" Strategies

The present generation represents the richest and most image conscious group of consumers ever. Strategies for the promotion of wood must capitalize on the appearance, warmth and feel of wood. By inference, these strategies will emphasize the lack of variation and the cold, clinical appearance and feel of substitutes.

Rapid Response Strategy Implementation

Unfounded media presentations such as the UK's TV show "Your Home in Their Hands" showing shoddy construction techniques and much publicized fires at Bradford football stadium and Kings Cross tube station resulted in a dramatic loss of timber framed housings market share (Figure 7). This highlights a failure of the UK's wood associations to react promptly and decisively in informing the public of the facts. Using insurance company statistics, for example of the safety and performance of wood structures, worldwide would have presented a more objective, rational approach.

The inquiry and subsequent judicial inquiries into the two fires took over a year--during which the UK news media played into the hands of the powerful brick and concrete producers.

The lack of an organized wood industry response in the UK damaged the timber framed housing market share not only in the UK but also Europe, and directly impacts on all the suppliers of wood products to the UK for many years.

Now is the time to prepare and broadcast the virtues of wood--not two years after unprecedented adverse media attention fuelled by competing interests.

Strategies to limit substitution can be conveniently divided into three groupings:

- technologies;
- processes and products;
- organizational.

Technologies to Limit Substitution of Wood

A listing of technologies which, when developed and adopted in appropriate products and processes, would enhance the properties of wood and hence limit substitution is shown in Figure 9.

Figure 9
Technologies to Limit Substitution of Wood
By Enhancing/Extending its Utilization/Function

- Fire retarding treatments to defined codes and standards
- Precision kiln drying to stabilize size and permit enhancement processes such as gluing and painting
- On-line species sorting to ensure selection of appropriate species for each end use
- Environmentally safe in transit, anti-stain and service treatments
- Adhesive technology
- Patching of surface defect by filling or plugging
- Surface preservation and enhancement treatments such as stains, varnishes, and plastic coatings
- Densification including surface, limited depth or localized area densification or hardening
- Needle incising to enhance preservation and drying

A good example of a well developed but as yet under commercialized technology capable of modifying the physical properties of softwoods is densification.

Densification

Softwoods though light and strong are not as wear resistant as hardwoods and a chemical process to provide wear resistant surfaces only in the areas needed can now be applied to otherwise finished components. Other benefits can be embodied such as permanent colouration and preservation, while retaining the strength of the core material. Densification involves the introduction of a liquid plastic resin into the cell structure of wood and when sufficient penetration has occurred, solidifying that resin.

The wood to be densified is immersed in a liquid monomer plastic in a vacuum/pressure vessel and the air and water in the wood cells and cell walls is progressively replaced with the monomer due to the action of vacuum/pressure. Raising its temperature cures and converts the monomer to a long chained molecular polymer which both plasticizes and densifies the wood. Forging the wood during this procedure could further enhance is mechanical properties, further extending the range of possible products.

Typical products which could be made from modified density and/or forged softwoods include:

- exposed flooring;
- chair components;
- gun stocks;
- ornate furniture or signage, forged and densified, previously hand carved;
- knife and tool handles;
- kitchen ware (dishwasher proof items);
- baseball bats;
- snowshoe and bent wood parts;
- light switch covers;
- billiard cues;
- drum sticks;
- guitar frets;
- yacht deck fittings;
- archery bows;
- bobbins for textile looms;
- scrabble game pieces;
- mousetraps!

Laminated Veneer Lumber (LVL) Utility Poles

Having indicated previously that concrete and steel utility poles were replacing wooden poles, advances in wood processing technology has now permitted wood to "fight back". Forintek has produced an octagonal tapered tubular utility pole using finger jointed LVL (see "Forintek Review" Nov./Dec. 1988 issue). If commercialized, the LVL pole could offer benefits over its concrete and steel competition and even over traditional solid wood including:

- one-third the weight of solid wood;
- wood is one-fifth the density of concrete;
- veneers which have been needle incised and chemically treated offer superior penetration and protection than in solid wood.

Hybrids Can Provide The Optimum Substitution

Hybrids, meaning composites of wood and another material(s) can provide a product with the best combined properties, while offsetting a loss to either material. Examples of such hybrids are given in Figure 10. As noted before hybrids tend to cause "double accounting" errors in calculating market share etc.

Figure 10
Examples of Successful Hybrids of Wood and Other Materials

- Window frames with wood cores clad with vinyl (90% of Anderson exterior windows are vinyl clad)
- Densified wood using impregnation with plastic long chained molecular resins
- Laminations of plastic film or sheet on wood substrates for furniture, signage, cabinetry
- I-beams using MSR wood or LVL chords and steel (wiggle-strip) webs
- Foam filled factory built modular housing wall units

Plywood Bodied Cars

International Panel and Lumber Pty of Australia have produced a prototype plywood bodied car called the "Africar". Five hundred Africars are on order.

Specifically built for use in the third world the following advantages of wood were cited:

- domestic wood limits need for imported steel or a sophisticated car assembly plant;
- both the car and the plywood are ideal for manufacture in under-developed countries with existing carpentry skills and tools;
- light body permits good fuel economy and low wheel footprint pressures for soft roads;
- body repairs easily undertaken with available carpentry skills and tools;
- excellent corrosion and termite resistance offered by epoxy resin plywood;
- strong yet flexible construction ideal for rough roads;
- vehicle cavities can be foam filled and hence amphibious.

Wood Fibre Reinforced Plastics for Car Panels

Experimental car body panels made from wood fibres in phenolic resin have been tested by General Motors in applications such as Corvette door panels, Cadillac Fleetwood hoods, Cadillac unit body floor pan and exterior body panels for the Fiero.

Two Hybrid Plywood Products

1. The Indian Plywood Industries Research Institute at Bangalore has developed a plywood having one ply made of steel wire mesh or steel sheet. The mechanical strength is increased, there can be a significant savings in the wood employed and it can be rolled or press formed into two dimensional curves.

2. Permali of Gloucester UK manufacture a plywood from veneers impregnated rubber solution to form a resilient and shock absorbent sheet. Called Permawood Hi-Damp, this plywood is capable of bending and deflecting to absorb shock, vibration, impact and sound resonance.

Processes and Products to Limit the Substitution of Wood

New technology and the adaptation of existing technology is increasingly being employed to modify production processes to permit new or modified wood products to limit substitution--or even to recapture markets previously lost of plastics or metals.

A listing of examples of such processes and their products is shown in Figure 11.

Figure 11
Examples of Products Technology and Processes
Which Limit (or Recapture) Markets from Substitution

- MSR graded wood
- Densified softwood wood items such as described earlier
- Treated wood (against decay or fire)
- Laminated wood items (LVL or glue laminated) such as Forintek's LVL utility pole or scaffold planks
- Hybrids involving say plastic coatings or metal components like I-beams
- Car panels, MDF dash boards, body panels, door skins
- Australia's "Africar" plywood car body
- Forged (curved) items like chair backs
- Pressure embossed decorative items replacing injection mouldings
- Edge and face gluing and finger jointing
- Laminating with plastic foils and overlays
- Grading using machine vision for defect recognition

A excellent example of a process and product limiting the substitution of wood is provided by Laminated Veneer Lumber (LVL). By laying up sheets of machine stress rated veneers, all having their grain oriented lengthwise, exceptional strength and precisely controlled strength performance can be obtained. Products where the strength to weight ratio, combined with other properties such as say electrical insulation can justify its premium price. Examples of LVL recapturing markets temporarily held by plastic or metal include:

- scaffold planks;
- water skis;
- cross country skis;
- ladder rails and treads;
- I-beams for trusses and joists;

- hockey stick shafts;
- crutches.

Parallam is another good example of a new wood product that can compete with non wood products.

Industry Must Get Organized!

The BC Forest Products Sector spends approximately 0.2% of sales value on product promotion.

Campaigns to educate the public about wood are numerous and examples of two are examined. Ongoing fulltime effort at both the general public and the consuming industry level is well undertaken by such associations as COFI but the focus of these efforts have been offshore, whereas most of Canada's wood is sold in North America.

A greater and more coordinated effort is needed to promote wood. Some of the aspects needing greater attention are:

- accurate and current market research data;
- make it easier to use wood;
- common grading and product specifications and terminology;
- common Q.C. procedures and training;
- end user education programs (such as COFI);
- improved standards for packaging;
- regular field visits to end users to identify concerns or future opportunities;
- help end users be successful--assistance with gluing or finishing problems;
- greater cooperation between primary and secondary producers to benefit the end user.

UK's Timber Trade Federation's "Think Wood" Campaign

In 1987, despite near record sales of £5-7 billion, the UK's Timber trades Federation (TTF) representing the UK's timber industry spent a mere £225,000 on promotion of wood. The TTF's campaign was called 'Think Wood' and a market research firm was employed to identify exactly who was responsible for specifying wood--or a substitute--in buildings. It was found that architects client-companies had a major say in the volume of wood used in their buildings.

This means that company directors--as much as architects, builders and interior designers--are a key factor in the decision marking process. But how did they regard timber?

Further research threw up some worrying statistics reflecting timber's poor profile against competitors:

- an astonishing 42% of those questioned were unable to recall any technical development in timber within the last three years;
- 25% of those questioned expected to use less timber and wanted to substitute other products.

So in the eyes of major specifiers, when it came to serious engineering components, timber is seen as last year's product.

In the trade's favour it must be said that 87% of those questioned liked the idea of timber in their own homes.

Due to the limited budget, TV and radio advertisements were discounted in favour of a full page advertisement (shown in Appendix 1) in the combined 2.1 million copies of four major newspapers.

Forintek's "Wood Works" Campaign

Forintek have initiated a wood awareness campaign entitled "Wood Works", as is illustrated in Appendix 2. As a demonstration of its commitment to wood, Forintek's new $30 million research laboratory building in Vancouver will employ a wide variety of wood products in all aspects of its construction.

Other superb examples of BC office locations demonstrating commitment to, and celebration of, wood include:

- Lignum at Williams Lake and Vancouver;
- Rustad Bros. - Prince George;
- Decker Lake - Burns Lake;
- Weyerhaeuser - Kamloops and Vavenby;
- COFI HQ - Vancouver;
- Brunette Machinery (now Durand Raute) office in New Westminster.

5
WOOD MUST FIGHT BACK!

Offense being the best defense, those concerned with the substitution of wood by other materials need to identify and adopt strategies focussed on the consumer.

The UK's Timber Trade Federation's "Think Wood" campaign (Appendix 1) and Forintek's "Wood Works" campaign (Appendix 2) are worthy beginnings to fighting back in that they are both admissions that the competitive threat exists, and demonstrations that the respective wood industries have organized, considered alternatives, raised funds and made a public effort.

More is needed. The competition is well organized and aggressive and appears to have a better knowledge of what is happening in the marketplace at the consumer level. Most of the sources identified in this report have been from competitive industry or offshore markets. The forest industry needs to know more about how its products are used - particularly in North America.

Armed with this knowledge the industry can then adopt aggressive research, development and promotional strategies to recapture and increase market share for higher value products.

APPENDIX 1

ADVERTISEMENT FROM UK'S TIMBER TRADES FEDERATION
"THINK WOOD" CAMPAIGN

Did you know that wood, when properly preservative treated, can last indefinitely?

Or that wood stands up to corrosive atmospheres more effectively than most steels?

Or that its strength-to-weight ratio is substantially greater than most common metals?

The latest timber products are more durable and perform more predictably than ever before.

Today you can buy timber that is already preservative treated and backed by a 'lifetime' guarantee.

Stress-graded timber, with guaranteed structural performance is widely available.

Modern design techniques and new developments in paint and coatings technology can dramatically reduce maintenance.

Complex, precisely engineered structures are now easily built in wood, using factory-controlled prefabrication.

For anyone who is building to last, the arguments for wood are stronger than ever before.

If you're working on a major project and would like further information, write to The Timber Trade Federation, Clareville House, 26/27 Oxendon Street, London SW1Y 4EL.

As the Timber Industry's leading body, we'll be happy to put you in touch with technical help and specialist suppliers.

All you need, in fact, to make future generations eternally grateful that you chose wood.

Think Wood

The Timber Trade Federation.

Have we found the secret of eternal life?

Use your head. Think Wood.

Medium Density Fibreboard

New-technology composite wood panel. Remarkably stable with outstanding machining and finishing qualities. Currently creating a revolution in British furniture.

Glulam

A lamination process, producing wide load-bearing spans. So strong, it forms a key part of the structure of the Thames Barrier.

American Oak

Douglas Fir

Afrormosia

Western Red Cedar

Softwood Plywood

Strength and performance characteristics well proven in timber-frame housing throughout North America. It's making homes for more Britons, too.

Trussed Rafters

Highly cost-effective roofing system, producing reliable, engineered structures. Now used in ninety per cent of new domestic roofs.

Padauk

Lime

Parana Pine

Wenge

Machine Stress Graded Timber

Softwood with guaranteed structural performance. Each piece tested every 15 cm of its length.

Preservative Treated Windows

Window frames that withstand the elements. And that's no rot.

African Mahogany

Teak

Flooring

Timber products have always been first choice for floors. Moisture-resistant chipboard is one of the industry's latest developments.

Decorative Woods

You can't imitate the warmth and visual appeal of wood. And there's never been a wider choice of wood finishes.

Did you know that wood can resist corrosive atmospheres more effectively than most steels?

Or that it offers built-in fire endurance? (Unlike pre-stressed concrete and many plastics, wood won't crack, melt, soften or flake).

The latest timber products perform altogether better and more predictably across a wider range of applications than ever before.

Don't close your mind to the design opportunities.

If you're working on a major project, please write to The Timber Trade Federation, Clareville House, 26-27 Oxendon St, London SW1Y 4EL for technical advice and information on suppliers.

After all, two heads are better than one.

Think Wood

APPENDIX 2

President's Message

Wood Works

Forintek's theme this year is something that everyone knows. Whenever wood has been available, even as a luxury import, people have used it to build their dwellings and enrich their lives. Paradoxically, however, this wide acceptance has also let wood be taken for granted. People don't see in it what the scientists and engineers in our industry see: that wood is a space-age material capable of amazing things. Beyond all doubt, "WOOD WORKS."

As a solid structural material, wood's strength-to-weight ratio compares favorably with that of other materials. This has long been known empirically — the majority of single-family dwellings are still framed in wood. Wood is functional. Wood has also provided aesthetic pleasure to generations of people around the world.

But times are changing, and these changes will harm wood markets if we are unprepared. Forintek economic studies show that North American housing, long the mainstay of Canada's lumber sector, will no longer be a growth market if present trends continue. Even more disturbing, the houses that are built will contain less wood. Non-wood materials are steadily eroding customary wood uses because of advantages in price, availability, and ease of use.

Are alternative markets possible for Canada's structural wood products? Very much so — particularly the market for light structural frames in commercial and industrial construction, now predominantly concrete and steel. There is no technical reason why wood products could not compete effectively with these traditional materials with equivalent safety, cost-effectiveness, and customer satisfaction.

Before this can happen, however, codes must be satisfied. This requires that complete data on wood's structural and fire properties must be derived by a respected and independent research agency. Forintek is achieving this by its extensive wood characterization program, which addresses the changing forest resource; and by its leadership programs in wood engineering and building construction.

Steel and concrete, and to some extent plastics and ceramics, have already used research data to their advantage. Ten years ago, non-wood materials were essentially no easier than wood for a building designer to specify. As a result of R&D efforts, however, non-wood materials are now comparatively more designer-friendly. This is just one reason they have become so successful in the market for commercial and industrial light frames in North America, a market that unlike housing is expected to show continued growth.

If wood is to gain access to non-residential construction markets and compete effectively, then it will have to show itself to be as much of an engineered material as its competition. Only then will the world see that "WOOD WORKS" — not only for housing, but also for offices, warehouses, shopping centres, and the like.

The wood products industry has developed its technological infrastructure over many decades mostly to support its important role as a low-cost producer of commodity products to satisfy international markets. But today, industry's challenge is to differentiate and

diversify its products so that it can harvest healthy profits from a changing global economy. Increasingly, industry recognizes that technology advancement is an essential element in its response to the challenge.

Forintek is contributing to industry's technology advancement in numerous ways. One approach involves a recently-completed study for a proposed new Forintek Western Laboratory in Vancouver. The study showed that a large commercial building could be designed to satisfy all existing fire and structural codes, while maximizing use of wood in occupancies as varied as office, laboratory, and pilot plant. The building would relieve a serious space problem for Forintek's western operations, and would function as a unique showcase for modern wood construction. The project would show the world that for commercial and industrial light frames, "WOOD WORKS" with maximum efficiency and cost-competitiveness.

But while good ideas are necessary, they are not sufficient by themselves. History is full of good ideas that came to nothing because they remained simply ideas and were never translated into material form. In other words, technology advancement requires technology transfer. Recognizing this, Forintek has emphasized its workshop and seminar programs, encouraging discussion about best available technology and bringing its own staff into closer contact with mill people. About six thousand industry personnel have attended these Forintek programs in recent years. More of this type of technology transfer is planned.

Effective technology transfer also demands not just participation, but real belief. At Forintek we call a firm that is willing to work with us on proving a new technology, its "champion." Being an industrial champion is hard work. But as those who volunteer to become champions know well, it is also extremely rewarding. Champions gain lead time in key new technologies, with the competitive edge that extra time confers. Champions have a head start in educating their employees, plus the opportunity to influence a new invention's final form. When all the hard work is over, Forintek's champions feel the satisfaction of having a new technology up and running when other mills are just starting to explore it.

This year over 20 companies, some large and some small, have worked closely with Forintek as industrial champions. Some companies have worked with us singly; others have worked in groups called "consortiums." All have contributed time, materials, and mill facilities; but most importantly, they have contributed their enthusiastic will to innovate — to do things even better tomorrow than today.

Thanks in large measure to such champions, industry benefits from Forintek programs are substantial. Last year Forintek undertook an extremely conservative program review that examined direct, documented paybacks from its research conducted from 1982 to 1986. That research paid back its total four-year cost ***five times over in only one year***, in the form of cost savings and profit improvements in the Canadian wood products industry. This benefit-cost ratio becomes even higher when one considers that the research will continue to benefit the Canadian economy for years to come.

The Forintek partnership concept that finances these impressive benefits constitutes a unique method of funding research in Canada. This funding partnership is better than any other model that might be considered for our industry sector today. The partnership will continue to work because all partners recognize the need for innovation in the solid wood products sector. Contribution funding this year was 53% federal government (through the Canadian Forestry Service), 20% provinces, and 27% industry.

The balance sheet shows that operating expenses were matched to available revenue. What is not readily apparent is that funding has declined in real terms every year for the past four years. Revenue planning was particularly difficult this year due to industry strikes and uncertainty about some government programs.

The Board recognizes the need to stabilize Forintek funding, and accordingly has recommended to industry that its membership dues increase. Once approved by the membership, this will be the first increase in membership dues since the partnership concept was initiated over three years ago in April 1984.

The Government of Canada, through the Canadian Forestry Service, recently reconfirmed its commitment to sustain and increase its support of Forintek. The province of Quebec signed a three-year contribution agreement in February to uphold wood products research at Forintek. Annual contributions are now being received from British Columbia, Alberta, Manitoba, and New Brunswick, and proposals have been made to all other provinces to participate in the Forintek partnership on a sustained and equitable basis.

The wood products sector is a vital part of the forest products industry — an industry that is Canada's largest, accounting directly or indirectly for one million Canadian jobs. This vital sector has a continuing and important role as a low-cost producer of high-volume commodity products for international markets. But the world around us is changing, and now we must also differentiate and diversify beyond a traditional commodity approach. To achieve this, technology advancement in the wood products sector is essential.

The wood products industry is vigorously demonstrating its willingness to meet this challenge; Forintek is demonstrating its ability to be the industry's leading force for technological advancement.

Tony French